Transformation For Growth

2014 Consultants & System Integrators Interchange

Compete in the Era of SMART.

IT Optimization with Enterprise Linux Server

Gene Fuh, Ph.D.
Director & Distinguished Engineer
System z Technical Enablement and Business Development

IBM

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SMART.

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System z 50th Anniversary
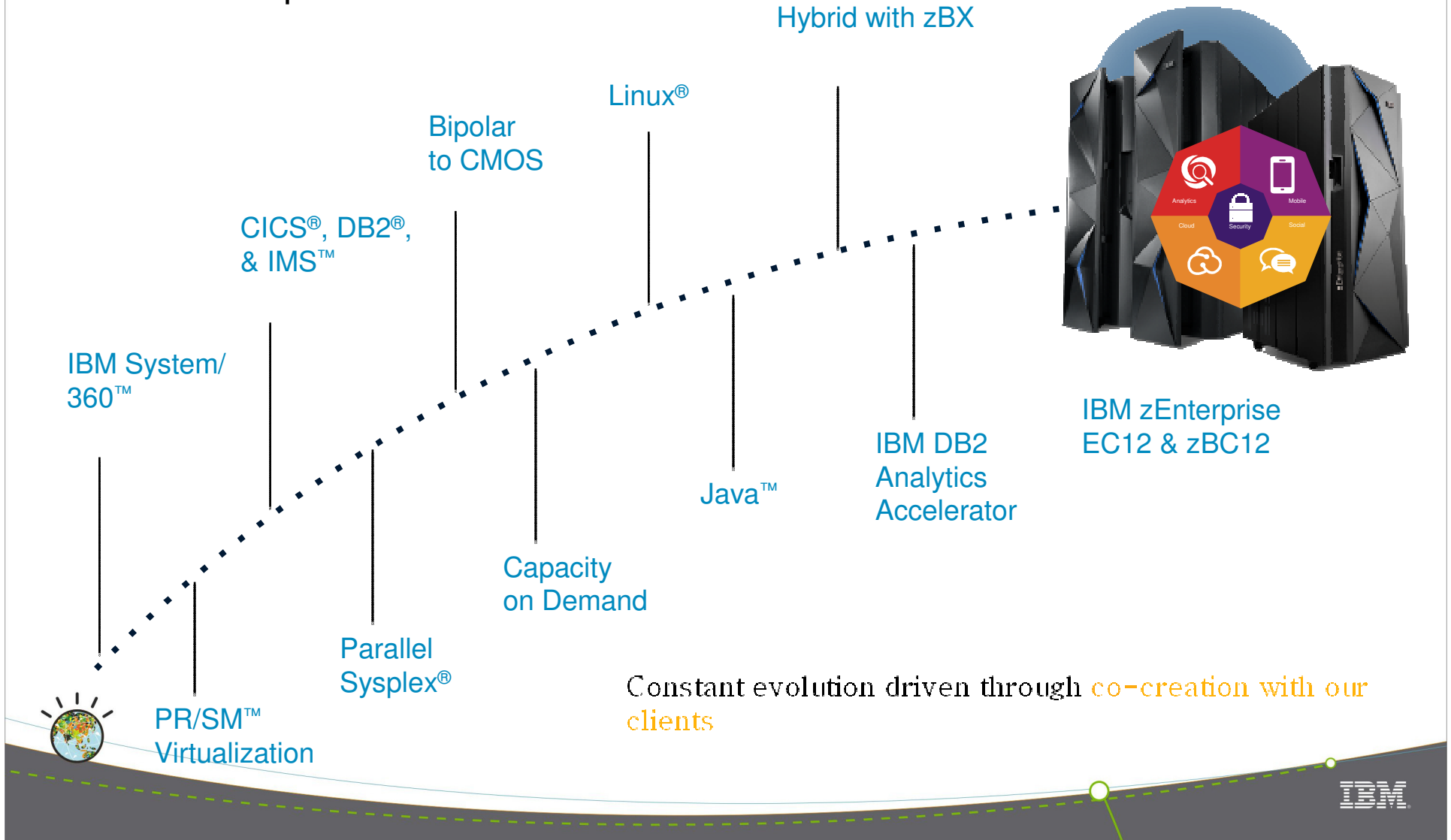
The first system z box installed in Asia in 1965

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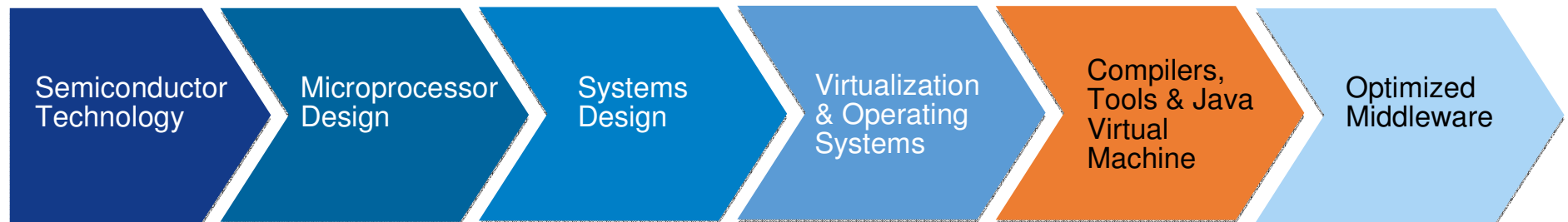# IBM's investment in the Mainframe has exceeded $55 billion…

Hybrid with zBX

Linux®

Bipolar
to CMOS

CICS®, DB2®,
& IMS™

IBM System/
360™

IBM DB2
Analytics
Accelerator

IBM zEnterprise
EC12 & zBC12

Java™

Capacity
on Demand

Parallel
Sysplex®

PR/SM™
Virtualization

Constant evolution driven through co-creation with our clients

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System z: Integrated by design
Enabling information-centric computing

Linux
z/OS
z/VM
z/VSE
z/TPF

AIX
Linux

Java

Rational.

WebSphere
Information Management
Tivoli
Lotus.
Business Analytics

Semiconductor Technology	Microprocessor Design	Systems Design	Virtualization & Operating Systems	Compilers, Tools & Java Virtual Machine	Optimized Middleware

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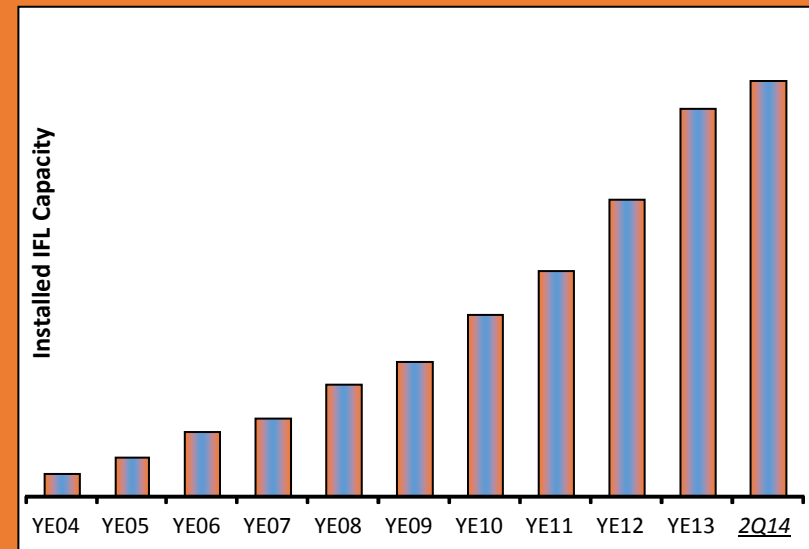System Integrators Interchange

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Linux on IBM System z in 2Q2014

Installed Linux MIPS at 49% CAGR*

- 26.5% of Total installed MIPS run Linux as of 2Q14

- Installed IFL MIPS increased 15% from 2Q13 to 2Q14

- 39% of System z Customers have IFL's installed as of 1Q14

- 79 of the top 100 System z Customers are running Linux on the mainframe as of 2Q14 **

- 34% of all System z servers have IFLs

- 56% of new FIE/FIC System z Accounts run Linux (FY10-1Q14)

Installed Capacity Over Time

Installed IFL Capacity

YE04 YE05 YE06 YE07 YE08 YE09 YE10 YE11 YE12 YE13 *2Q14*

* Based on YE 2003 to YE 2013   **Top 100 is based on total installed MIPS

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Modern Mainframe:

Continuous evolution for leadership in the new era of IT

The ultimate Analytics engine for instant insight

The foundation for a Mobile and Social enterprise

Superior service at lower cost through Cloud

A robust and Trusted infrastructure

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System z Delivers More Raw Processing Capacity Than Intel

	zBC12	**zEC12**
*World's **fastest** clock speed*	**4.2 GHz**	**5.5 GHz**
Total cores	**18**	**120**
Configurable cores	**6 GPs / 13 IFLs**	**101**
General processor core performance	**1064 MIPS**	**1,514 MIPS**
Specialty processor core performance	**1064 MIPS**	**1,514 MIPS**
Total Capacity	**4958 / 8733 MIPS**	**78,426 MIPS**

Maximum x86 clock speed = **3.4 GHz**

Maximum x86 cores = **32**
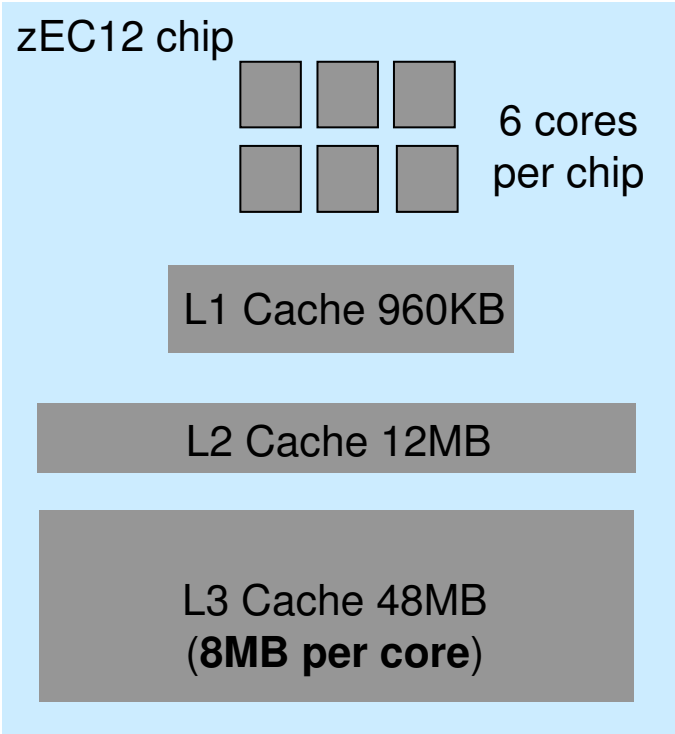
Intel Sandy Bridge

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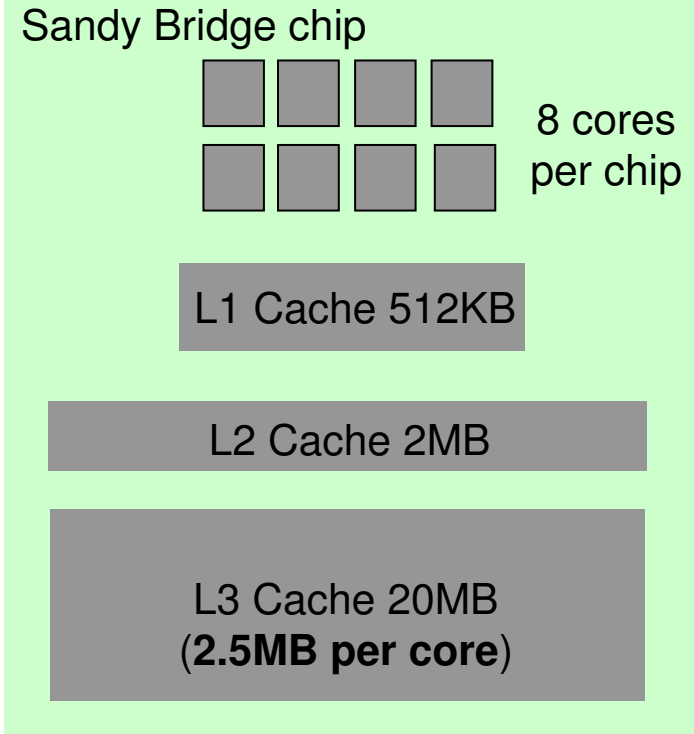2014 Consultants &
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System z Has More Cache Than Intel To Support Multiple Concurrent Workloads

zEC12 chip

6 cores per chip

L1 Cache 960KB

L2 Cache 12MB

L3 Cache 48MB
(**8MB per core**)

L4 Cache 1,536MB across 4 books

Memory 3TB

Sandy Bridge chip

8 cores per chip

L1 Cache 512KB

L2 Cache 2MB

L3 Cache 20MB
(**2.5MB per core**)

No L4 Cache
Processor reported busy during a memory fetch, but no useful work is getting done

Memory 768GB

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Sustains High CPU Utilizations With No Service Degradation

Recent Daily Samples Indicating Stress Extended Periods above 97%

Monday June 10, 2013

8:15 to Noon

06/10	8.15	91.90
06/10	9.15	91.00
06/10	9.30	95.30
06/10	9.45	99.10
06/10	10.00	99.90
06/10	10.15	98.80
06/10	10.30	99.80
06/10	10.45	99.80
06/10	11.00	100.10
06/10	11.15	100.10
06/10	11.30	99.40
06/10	11.45	97.60
06/10	12.00	99.70

Noon to 5PM

06/10	12.15	97.00
06/10	12.30	97.00
06/10	12.45	90.40
06/10	13.00	91.20
06/10	13.15	92.90
06/10	13.30	95.70
06/10	13.45	96.00
06/10	14.00	99.40
06/10	14.15	100.00
06/10	14.30	99.10
06/10	14.45	98.10
06/10	15.00	97.60
06/10	15.15	99.60
06/10	15.30	99.80
06/10	15.45	99.00
06/10	16.00	99.60
06/10	16.15	97.40
06/10	16.30	92.40
06/10	16.45	90.50
06/10	17.00	94.20

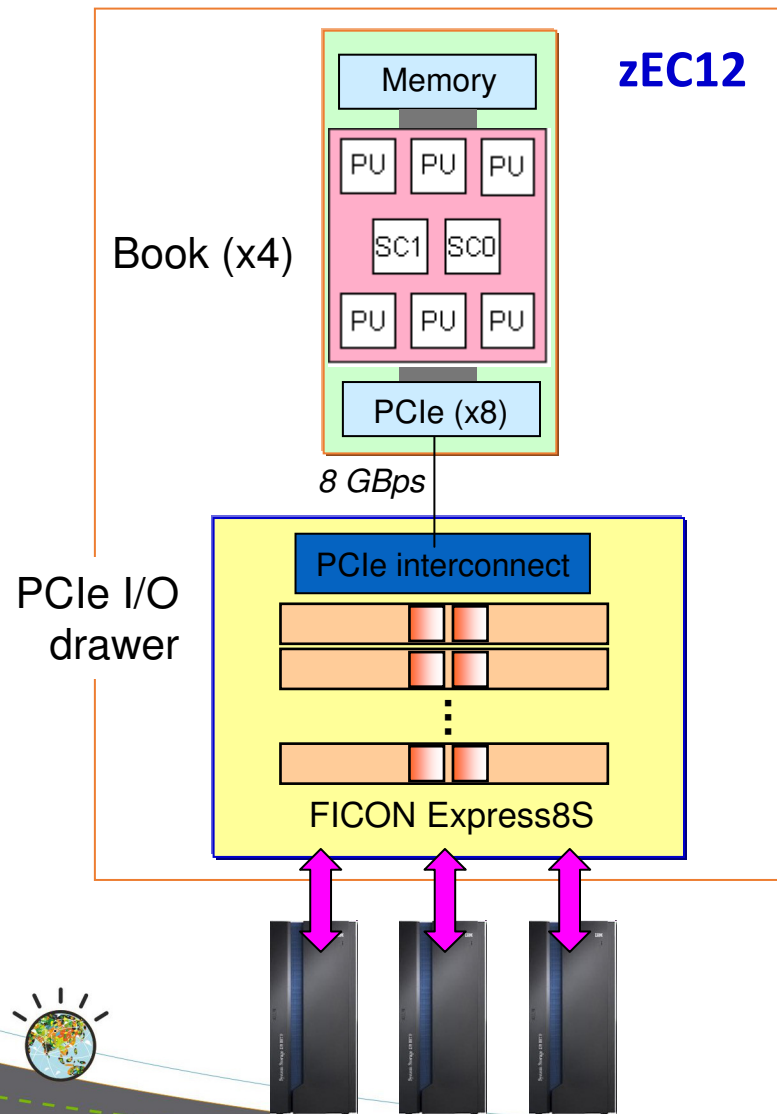| Sustained Peaks	Number of Days	Dates
100%	2	4,10
99%+	6	3,4,6,10,19,25
97%+	9	3,4,6,10,11,19,24,25,26

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zEC12 Has A Dedicated I/O Subsystem Which Can Deliver 1.7M I/O Operations Per Second

- **Up to 16 dedicated System Assist Processors (SAPs)**
  - I/O requests are offloaded to SAPs
  - SAPs can sustain up to 2.4M IOPS*
  - I/O subsystem bus speed of 8 GBps
  - Number of SAPs increases from 2 to 16 according to system size

- **Up to 160 physical FICON cards for I/O transfers**
  - Up to 320 RISC processors (2 per card)
  - Up to 320 FICON channels (2 per card)
  - 8 Gbps per link, 288 GB/Sec I/O aggregate per zEC12

- **IBM DS8800 Storage System**
  - Up to 440K IOPS capability

- **Delivers I/O efficiency at scale**

* Recommend 70% max utilization – 1.7M IOPS
Numbers represent High Performance FICON traffic
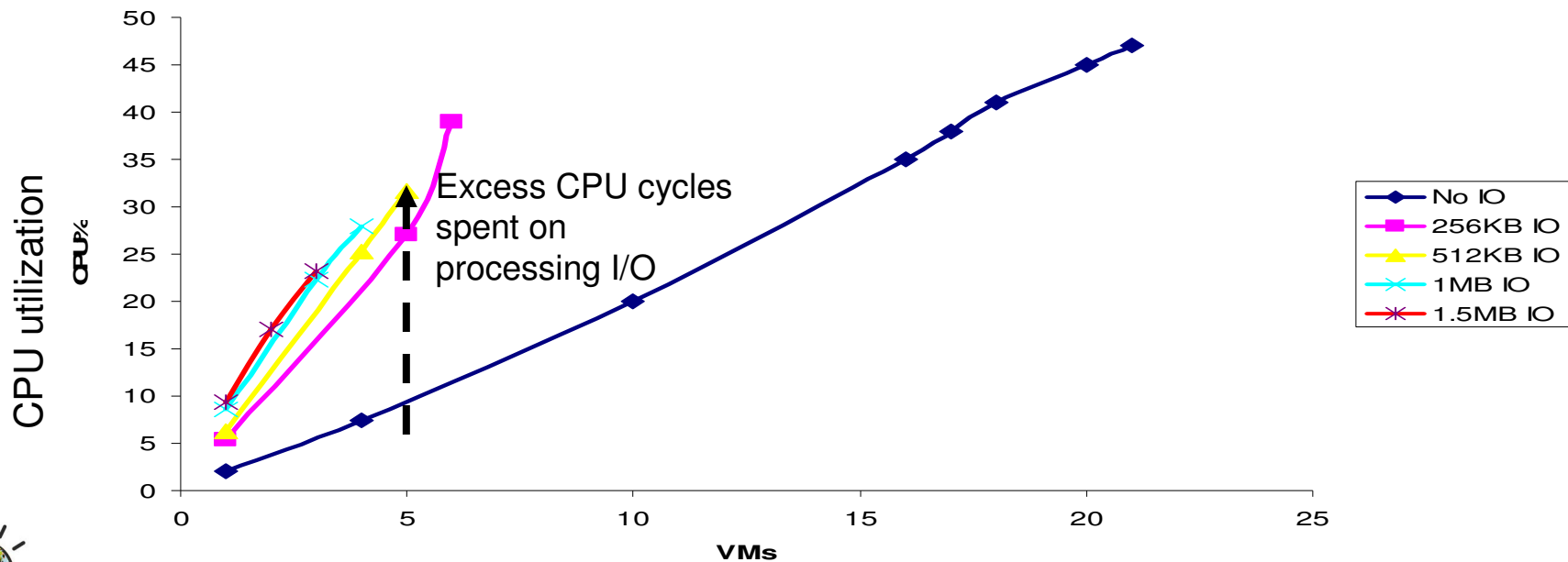
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System z's Dedicated I/O Subsystem Delivers More I/O Processing Capacity Than Intel

- Intel's performance degrades as I/O demand increases
  - No dedicated I/O subsystem
- Test case scenario: Run multiple virtual machines on x86 server
  - Each virtual machine has an average I/O rate
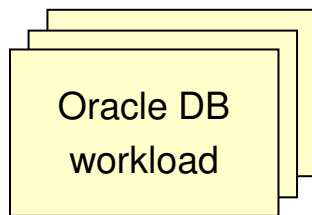 - x86 processor utilization is consumed as I/O rate increases

Intel CPU As IO Load Increases

CPU utilization

Excess CPU cycles
spent on
processing I/O

Legend:
- No IO
- 256KB IO
- 512KB IO
- 1MB IO
- 1.5MB IO

VMs

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Consolidated Oracle DB Workloads Benefit From Linux On System z

Which platform provides the lowest TCA over 3 years?

Oracle DB workload

Customer Database Workloads each supporting 18K tps

Oracle Enterprise Edition

Oracle Real Application Cluster

3 Oracle RAC clusters
4 server nodes per cluster

12 total HP DL580 servers (192 cores)

$13.2M (3 yr. TCA)

3 Oracle RAC clusters
4 nodes per cluster
Each node is a Linux guest
zEC12 with 27 IFLs

$5.7M (3 yr. TCA)

TCA includes hardware, software, maintenance, support and subscription.
Workload Equivalence derived from a proof-of-concept study conducted at a large Cooperative Bank.

Half the cost

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Compete in
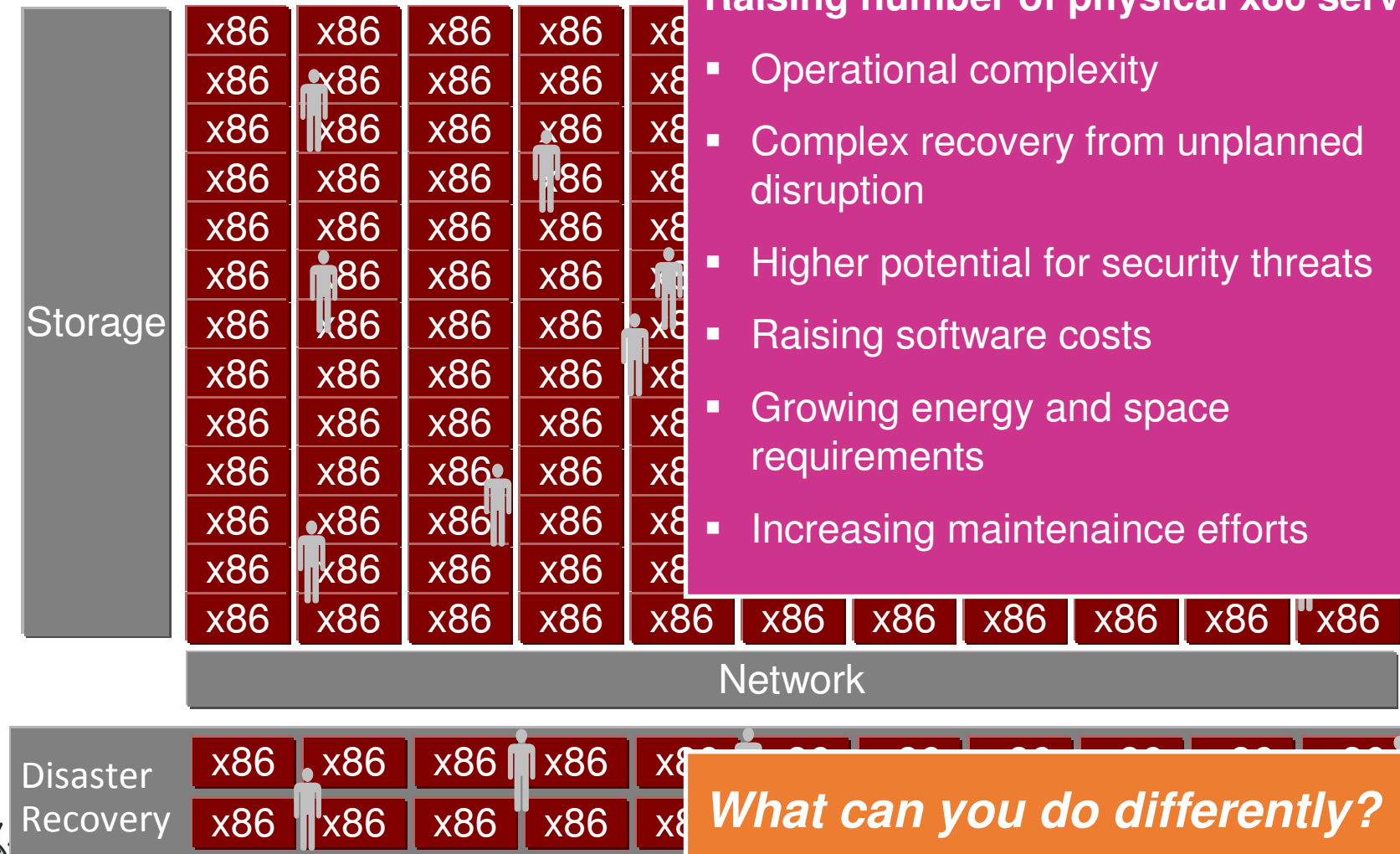the Era of
SMART.

IT Situation Tomorrow?

Storage

x86 x86 x86 x86 x86
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x86 x86 x86 x86 x86
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Raising number of physical x86 servers

- Operational complexity

- Complex recovery from unplanned disruption

- Higher potential for security threats

- Raising software costs

- Growing energy and space requirements

- Increasing maintainence efforts

Network

Disaster Recovery

x86 x86 x86 x86 x86
x86 x86 x86 x86 x86

What can you do differently?

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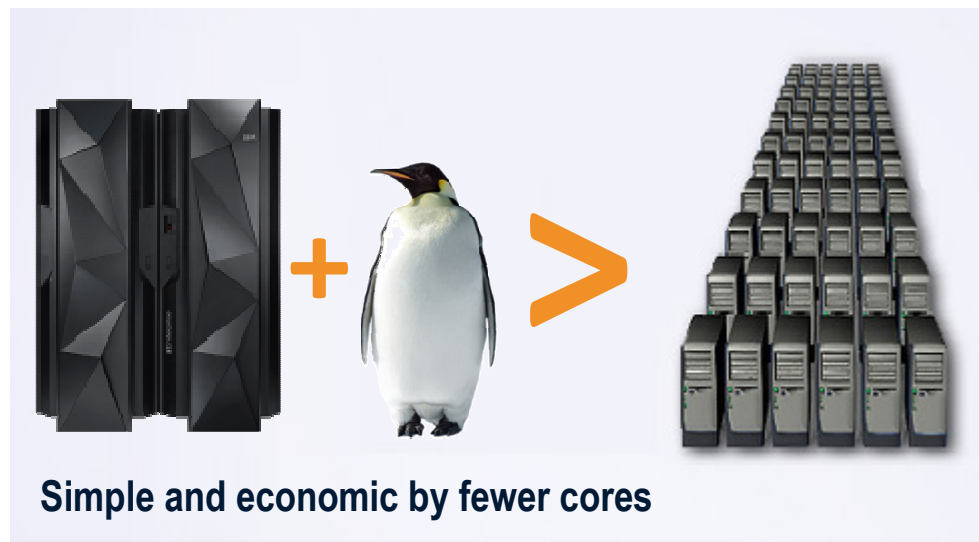
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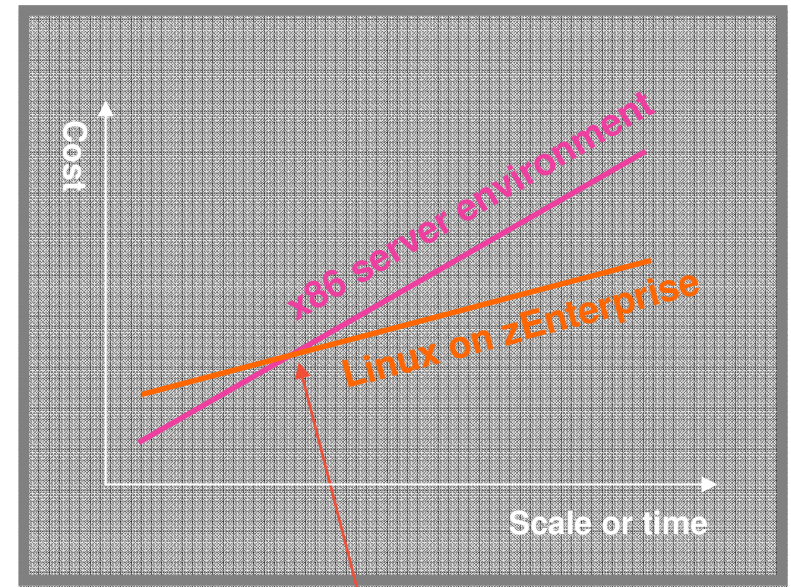# Solution Scale and Lifespan significantly impact the Cost Equation

- **Acquisition costs:**
  - Hardware, systems and application software, maintenance and S&S

- **Operating costs:**
  - Application software license, labor, energy, floor space

Typically, the larger the scale or the longer the lifespan of the solution,

operating costs become

relatively more important

Scale, lifespan and individual workload characteristics all impact the position of the cross over point
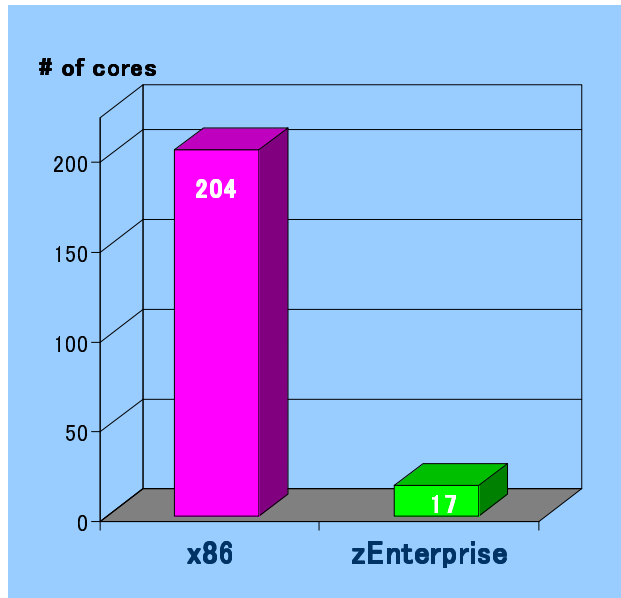
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Enomous Saving in Software Costs

# of cores

204

17

x86   zEnterprise

Consolidating from
204 x86 cores to 17 IFLs

The high
processor
utilization on
IBM
zEnterprise®
also contributes
to the software
savings.

Met Office

"Commodity x86-based systems do cost far less to acquire ...
But the longer-term costs quickly add up."
Richard Cains, technical lead, mainframe team, the Met Office

• Approximately 75 percent reduction in software costs

• Consolidation ratio of approximately 12:1

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New Accounts benefit from Operational Efficiency

66% % of the managers see achieving **operational efficiency** as the **most pressing issue**[1]

[1] according to survey conducted by Excellence in Government

Algar Telecom

"We have completely transformed our infrastructure …

*… our **operational efficiency** has **increased** by at least **30%** …"*

Rogério Okada,
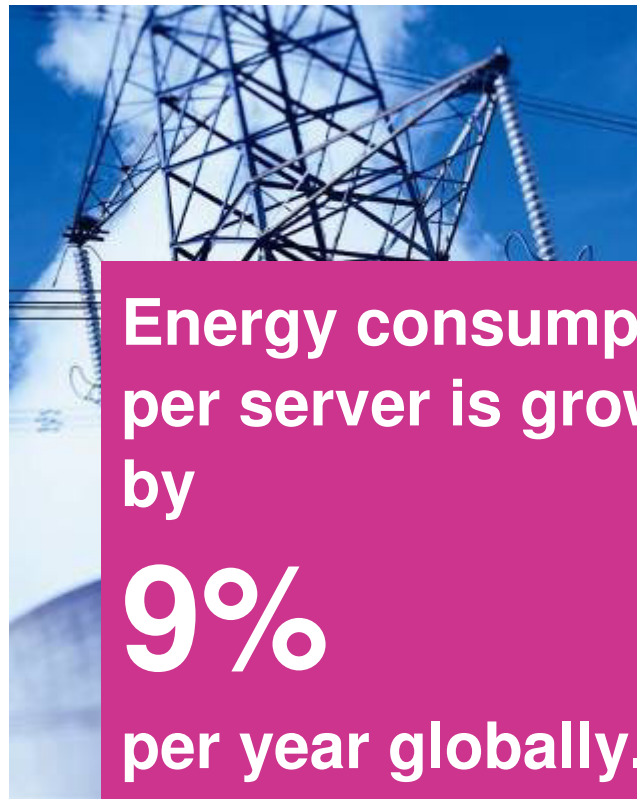IT Manager, Algar Telecom

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Solving Environmental Problems - Saving Energy and Space

Energy consumption per server is growing by

9%

per year globally.[1]

Sicoob

"… we are spending ***400% less on power*** *than if we had a distributed environment instead."*

Ricardo Antonio,
CIO at Sicoob

Avoiding
~ USD 1.5 million
of electricity costs per year

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Meet stringent IT service delivery requirements

53% of clients **never recoup** the losses incurred by a disaster.[1]

ZIVIT (Center for Information Processing and Information Technology of the German Government)

„... *superior business continuity solution that helps us* **efficiently protect and manage** *our infrastructure to* meet *customer availability demands.*"

Manager system management IBM System z server, ZIVIT
(Zentrum für Informationsverarbeitung und Informationstechnik)

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Linux on zEnterprise

- **Data enter simplicity inside one server**

- **Trusted operations**

- **Unrivaled economics**

| LPAR	Logical Partition
	= subset of hardware resources, virtualized as a separate computer; up to 60 LPARs can be configured
IFL	Integrated Facility for Linux® = core;
	up to 101 cores running at 5.5 GHz on a IBM zEnterprise EC12 (zEC12)
Linux Guest	virtual Linux guests running workloads such as mobile, analytics, databases, Java™ apps, etc.;
	up to thousands virtual Linux guests can be hosted on one zEC12
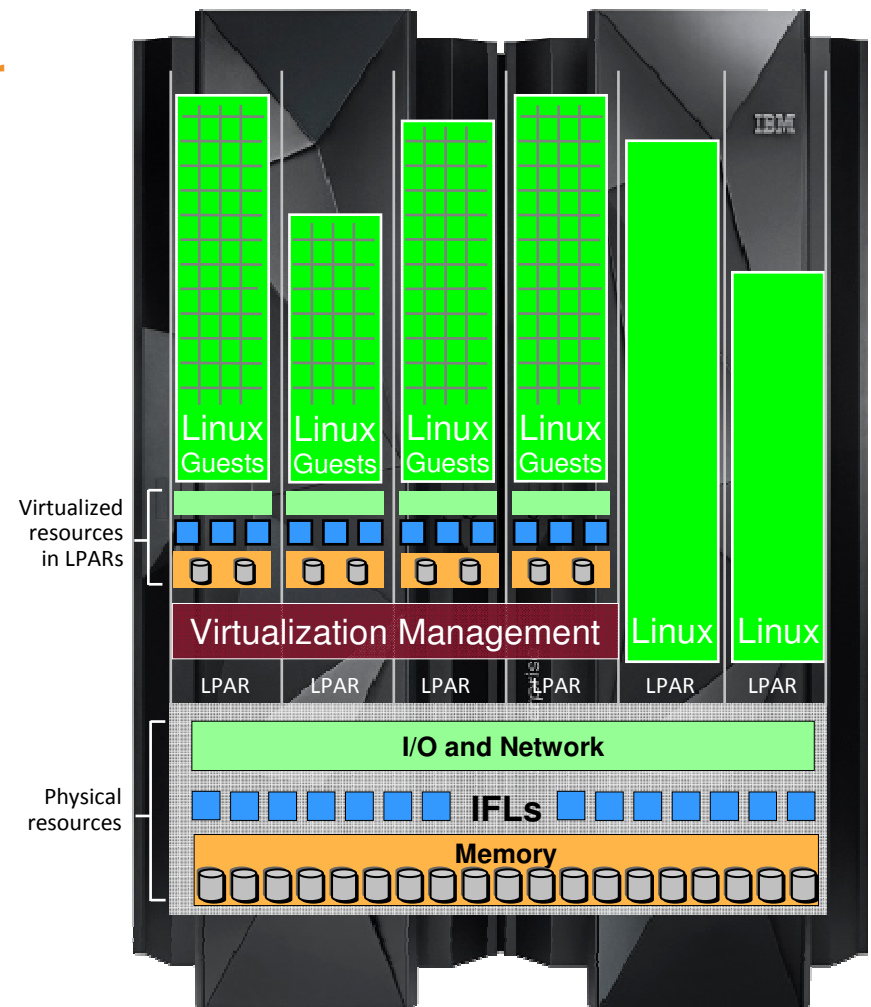
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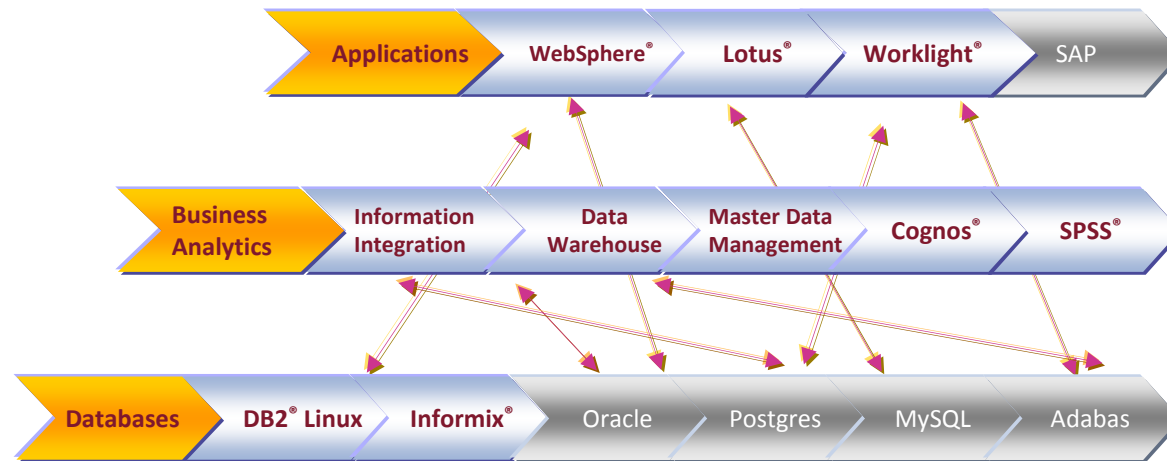
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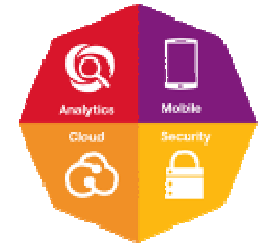
Linux on zEnterprise
The real alternative to server sprawl

Applications and data deployed on the same physical server

- Access from all applications to all data
- Centralized management
- High performance
- High security

| Applications | WebSphere® | Lotus® | Worklight® | SAP |

| Business Analytics | Information Integration | Data Warehouse | Master Data Management | Cognos® | SPSS® |

| Databases | DB2® Linux | Informix® | Oracle | Postgres | MySQL | Adabas |

Solutions in virtual **Linux** servers

Virtualization Management
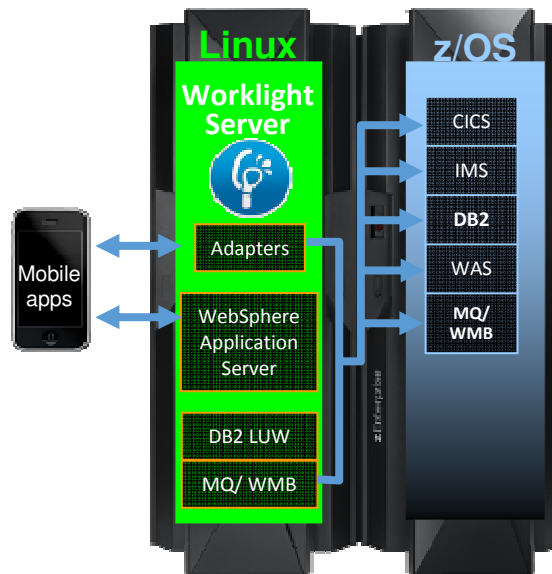
Hardware resources

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Mobile

Connecting Mobile Apps on the zEnterprise

- **Server side software components and adapters for channeling zEnterprise to mobile devices** with IBM Worklight Server

- **Mobile application support** with WebSphere Application Server on zEnterprise

- **Mobile protocol connectivity with core zEnterprise applications** including CICS®, IMS™, TPF, MQSeries®, WMB and DB2

Linux

Worklight Server

Adapters

Mobile apps

WebSphere Application Server

DB2 LUW

MQ/ WMB

z/OS

CICS

IMS

DB2

WAS

MQ/ WMB

Banca Carige

"Running our
mobile banking service
on
Linux on zEnterprise
is another step forward
in our
continual evolution
on the mainframe."

Daniele Cericola,
ICT Governance Manager,
Banca Carige

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Excellent Platform for Oracle Database Deployment

- **Scales well with virtualization capabilities**
  - Great scalability or single large databases
- **Overall cost improvement**
  - One IFL can run the workload of multiple x86 cores
  - Less operational efforts
- **High levels of security and availability**
  - Inherited hardware Quality Of Service
  - Isolated and protected virtual Linux servers

Analytics

Oracle DB
&
Oracle Fusion
Middleware

Linux

Virtualization
Management

Hardware
resources

z Enterprise

IBM

Banco do Estado do Rio Grande do Sul S.A. (Banrisul)

Cut the number of CPUs more than

50 %

to support credit database

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Building an Infrastructure for Real-time Insights

Workload-optimized system for both operations and analytics workloads

- Access, combine & manage a mix of information

- Central data security and governance

- Deliver insights more quickly and at less cost than alternative solutions

- Provide a single source of data

- Integrated technology for high performance analytics

- Avoid the high cost of ETL

End-to-end Solution

IBM DB2 LUW

IBM InfoSphere™ Warehouse

IBM InfoSphere DataStage®

IBM Cognos Business Intelligence

IBM SPSS Predictive Analytics

Business Anylytics

Data warehousing

Data transfor-mation

Business System / OTLP

Virtualization Management

Hardware resources

White Cube

•**Informed decisions - based on real time**

•**Moved from an x86 based environment to an Enterprise Linux Server**

Integrated centralized approach running on one server

Analytics

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Unmatched Security and Availability for trusted Computing

$5.5M
The average cost of a
security breach

$500K
The average cost of
system failure

Highest
**Assurance level of security
with Common Criteria
certification (EAL 5+)**

Encryption
**of data at rest,
in flight, and in use**

Enterprise Key Management
**across mainframe
and distributed**

IT Analytics
**to spot potential failures
and capacity needs
before they occur**

99.999%
**Design point for
application availability**

Zero
**Second recovery point
objective across
thousands of miles**

Security

German Pension Fund

"The [System z®] server is extremely reliable and provides unmatched availability compared to other solutions."

— Falk-Oliver Bischoff, IT Director, German Pension Fund Baden-Württemberg
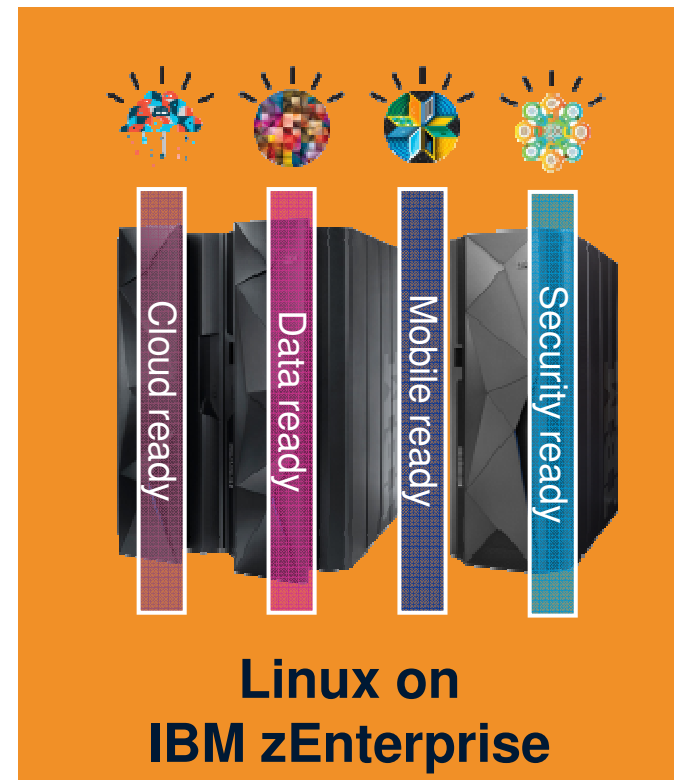
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IBM zEnterprise is open for all Solutions

Capitalize from transformative technologies

- Mobile applications
- Analytics and Data services
- Business applications
- Social services
- Development & test
- Security & Infrastructure services
- Business Process Management
- Enterprise Content Management
- Industry Solutions
- Cloud

Cloud ready

Data ready

Mobile ready

Security ready

**Linux on
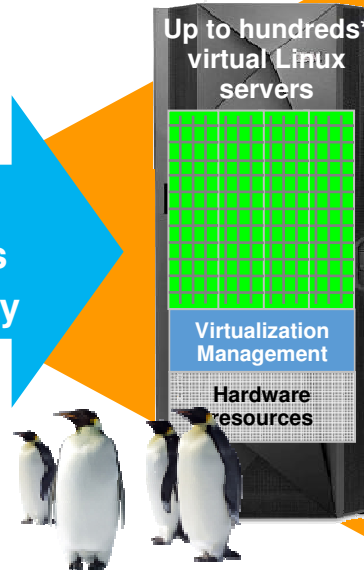IBM zEnterprise**

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The right Solution: Linux on IBM zEnterprise

Improved effectiveness and efficiency

Up to hundreds* virtual Linux servers

Virtualization Management

Hardware resources

- Operational and management reduction

- Software acquisition and licensing cost reduction

- Maximized hardware utilization

- Network reduction

- Collocation of data and applications

- Floor-space and energy reduction

- Growth inside a server

- Improving security

- Disaster recovery cost reduction and simplicity

Linux on zEnterprise

Designed to provide unrivaled power, performance, security, and flexibility for all kind of Linux workloads in a single economical server, replacing the complexity of distributed systems.

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Thank You

IBM